Rehabilitation after stroke

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Stroke causes an estimated 5.54 million deaths worldwide each year.¹ The burden of stroke is set to rise over future decades because of demographic transitions of populations, particularly in developing countries.^{w1} Despite a meagre research investment^{w2} important progress has been made, reflected in various guideline initiatives.²⁻⁴ These guidelines relate mainly to stroke services in developed countries. The main burden of stroke to individuals and to societies is as a leading cause for disability—about 40% of stroke survivors are left with some degree of functional impairment. Reducing this burden requires optimising stroke prevention and improving acute care, but rehabilitation is equally essential.

What is rehabilitation?

The many definitions of rehabilitation, most of which apply well to stroke, can be confusing. However, a clear consensus exists that the purpose of rehabilitation is to limit the impact of stroke related brain damage on daily life by using a mixture of therapeutic and problem solving approaches (see box 1).²⁻⁴ The high incidence and prevalence of stroke imply that stroke rehabilitation should be a major component of health service provision. In England, for example, the healthcare costs

Box 1 | What is rehabilitation?^{w33}

Rehabilitation is a complex set of processes usually involving several professional disciplines and aimed at improving quality of life for people facing daily living difficulties caused by chronic disease. Most people (and their carers) after a stroke will require help from a specialist team of doctors, nurses, therapists, social service staff, and psychologists. Each person will need careful assessment by the team to identify rehabilitation goals that should be negotiated with, and agreed by, the patient. A goal is a small, measurable, discrete step along the path to recovery.

The key purposes of rehabilitation can be summarised as the “five Rs”:

- Realisation of potential: ensuring that the duration of contact with therapy staff has been sufficiently long to observe a plateau phase in recovery
- Re-enablement: focusing on promoting independence in daily living skills such as walking and dressing
- Resettlement: helping the person to leave hospital feeling safe, well supported, and confident
- Role fulfilment: helping the person to re-establish their status and personal autonomy
- Readjustment: helping the person to adapt to and accept a new lifestyle

SUMMARY POINTS

Most patients will need rehabilitation after a stroke
Strong evidence exists that organised, specialist inpatient care, such as that provided in a stroke unit, is associated with improved outcomes
Which therapies work best for which patients is uncertain
Good evidence exists that specialist rehabilitation teams improve outcomes during resettlement at home
Long term care is important, but how it should be organised is unclear

associated with stroke have been estimated at £2.8bn (£4.1bn; \$5.5bn) a year.^{w3} A stroke is not simply a brain disease but affects the whole person and the family. There are few other conditions of such complexity that require the challenge of providing highly individualised, complex treatments to large numbers of patients.

Sources and selection criteria

We searched the Cochrane Library for relevant systematic reviews and also searched Medline, CINAHL, PEDro (physiotherapy evidence database, www.pedro.fhs.usyd.edu.au/) and the Effective Stroke Care website (www.effectivestrokecare.org/). We identified and used evidence based guidelines.²⁻⁴

What is stroke recovery?

Population based studies of stroke recovery have shown that the time taken to achieve best functional performance for mild, moderate, and severe strokes averages 8, 13, and 17 weeks respectively.⁵ The times vary considerably between individual patients, but these averages provide a useful guide for the duration of rehabilitation contact time.

An acute stroke lesion has a core of irrecoverable neurones surrounded by an ischaemic penumbra of potentially viable neurones. Initial stroke recovery involves resolution of cerebral oedema, ionic fluxes, and inflammatory processes followed by recruitment and reorganisation of undamaged neural networks.^{w4} Later recovery is adaptive to the new circumstances of residual impact of the stroke on daily life activities.

Rehabilitation is relevant to both phases. Early rehabilitation (first few months) uses techniques that seek to influence the potential for neuroplastic change, and later rehabilitation encourages adaptive responses and coping strategies based on educational and psychological theory.^{w5}

Immediate rehabilitation

National guidelines now emphasise stroke as a medical emergency that requires urgent hospital admission.²⁻⁴ This implies that the stroke rehabilitation for most patients should start in hospital. The patients who are not admitted to hospital require rapid assessment by a specialist stroke rehabilitation team.

A Cochrane review provides conclusive evidence that patients who receive organised inpatient care (such as that provided by a multidisciplinary specialist team in a stroke unit) are more likely to be alive, independent, and living at home one year after stroke (numbers needed to treat, 33, 20, and 20, respectively) than patients who receive non-specialist care (such as that provided on medical wards).⁶ The benefits of organised stroke care were seen equally for older and young patients, male or female, and for all severity grades for stroke. Stroke units therefore should not have restrictive admission criteria: the aim should be to treat every patient with a new stroke in a stroke unit.

The improved outcomes associated with organised stroke care seem to be enduring and remain apparent five years after the stroke occurred.^{w6} Organised stroke care provided in generic rehabilitation wards is also effective, although probably less so,⁶ but the effects of integrated care pathways^{w7} and mobile stroke teams^{w8} are inconsistent and best avoided. In England less than half of patients admitted with a stroke are treated on stroke units,^{w9} and therefore outcomes for many patients are compromised.^{w3}

The development of a rehabilitation stroke unit largely involves collecting together dispersed patients and staff into a single ward area. This is usually achievable at minimum additional cost, making the stroke rehabilitation unit a particularly attractive healthcare technology.^{w10} Immediate admission to a stroke unit optimises acute care such that complications arising after stroke—such as aspiration pneumonia or dehydration, which can contribute to additional brain damage—are minimised.^{w11} This ensures a more favourable clinical context on which to start rehabilitation.

What is a stroke unit?

The benefits of organised stroke care do not seem to be linked to departmental setting, staff mix, or the amount of medical nursing and therapy input available.⁶ The most distinctive features seem to be coordinated care from a multidisciplinary team with integration of nursing; close involvement of carers in the rehabilitation process; staff expertise in stroke; and education, with training programmes for staff, patients, and carers (see box 2).⁶⁻⁷ These features need to be developed and can be readily assessed by national audit.^{w9}

What sort of therapy?

Physiotherapy after a stroke is valued highly by patients,^{w12} and two reviews provide strong evidence for its effectiveness.^{8,9} Which type of physiotherapy should be provided for which patient, however, remains uncertain. A review of 10 treatment intervention categories found strongest evidence for effective-

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The strongest evidence for physiotherapy is for training to restore balance and gait

ness for task orientated exercise training to restore balance and gait (for example, by practising moving from sitting to standing).⁸

Upper limb impairment affects most patients at the time of the stroke, with persisting problems for between a half and three quarters of them. A review of trials of exercise therapy for upper limb impairment concluded that evidence was insufficient to inform clinical practice reliably.¹⁰ The review showed that more intensive exercise therapy is beneficial, but the researchers could not identify a subgroup of patients most likely to benefit.¹⁰

Specific therapy techniques for which systematic reviews are available include constraint induced movement therapy (in which the unaffected arm is immobilised for a few hours each day^{w13}), treadmill training,^{w14}

Box 2 | Key features of a stroke unit

- Staff with a specialist interest in stroke or rehabilitation
- Routine involvement of carers in the rehabilitation process
- Coordinated care from a multidisciplinary team, including meetings at least once each week
- Information provided to patients and carers
- Regular programmes of education and training

The British Association of Stroke Physicians (www.basp.ac.uk) recommends that the minimum staffing levels on a stroke unit should be 1.0 consultant sessions per 10 beds; 8.0 trained or untrained nurses per 10 beds; 0.9 sessions of physiotherapy per bed; 0.7 sessions of occupational therapy per bed; 0.35 sessions of speech and language therapy per bed.

and aerobic exercise training (for example, using a cycle ergometer).^{w15} These treatment techniques all show promise, but individual studies have been small, with highly selected patients, and the effects on daily activities of greatest concern to patients are unclear (see table A on bmj.com).

Language impairment will affect about a quarter of patients immediately after a stroke and will persist in about half of them. Usual practice is to offer speech and language therapy, but these treatments are poorly researched.¹¹ Cognitive impairment (including memory impairment), spatial neglect, and attention deficits are common, but the effectiveness of treatments are unclear because of insufficient research (see table B on bmj.com). Patients may not progress as well as first anticipated—the commonest reasons include cognitive impairment and mood disorders. These should therefore be routinely identified using standardised assessment instruments, such as the mini-mental state examination (cognitive impairment) and the hospital anxiety and depression scale (mood state).

Emerging approaches to stroke rehabilitation include motor imagery^{w16} and robotics,^{w17} and interest in progressive resistance strength training has re-emerged.^{w18}

How much therapy?

The average amount of one to one therapy provided to a patient is very small—about 6% of the working day.¹² A review of inpatient and outpatient studies investigating intensity of therapy found that doubling the therapy significantly improved functional recovery but by only a small amount: about one point out of 20 on the Barthel index scale.¹² Although intensity of therapy is important, the organisation and delivery of care may also be important. In a trial comparing coordinated, specialist, multidisciplinary care (nurses and therapists) with care given on a

TIPS FOR GENERAL PRACTITIONERS AND NON-SPECIALISTS

- Become familiar with your local stroke rehabilitation services
- Research indicates that best outcomes are obtained by starting rehabilitation in a stroke unit
- Consider stroke as a long term condition (recovery/adjustment after stroke is usually prolonged)
- Patients and their carers value routinely arranged reviews to discuss progress
- Ask about information needs in relation to causes and effects of stroke, and stroke recovery (regardless of time since stroke)
- Check for common problems arising after stroke: falls, pain, mood disorders, continence problems, carer's stress
- Check if advice is needed about return to driving, work, and leisure activities

general ward—with the amount of care in both cases being similar—the coordinated care was associated with better outcomes.¹³

What can we do for the carers?

A stroke causes a considerable burden of care, with up to three quarters of patients requiring help with daily living activities.^{14 w19} Carer support is a key distinctive feature of organised, inpatient stroke services.⁶ A practical training programme for carers has been shown to be effective in decreasing burden and anxiety and depression among carers, and in improving psychological outcomes for patients¹⁵ and reducing costs.¹⁶

Resettlement at home

The timing of discharge from hospital is primarily determined by the level of support available at the patient's home for any functional disabilities. "Discharge" does not necessarily signify that maximum recovery from

A PATIENT'S PERSPECTIVE

21 January 2002. That's the date that changed my life forever. I was 51 years old.

Anyway the day was normal as far as possible. I went home after work, but was very tired and had a headache, but thought nothing of it. I suddenly felt sick and my right arm felt as if it was turning round and round. I then tried to stand up and found I could not as I had no feeling in my right leg and it wouldn't support me. The ambulance came and I was taken to hospital, where I was found to have extremely high blood pressure, and a CT scan showed I had had a brain stem bleed.

I was in the high dependency unit for three days, after which I was transferred to a room on my own. I was then later told I may be transferred to the local rehabilitation hospital but would have to wait as they only took 10 female patients at a time and there was no capacity at the moment. By this time I could pull myself into a sitting position in bed and would be hoisted into a chair next to my bed.

A couple of days after this I was told I was being transferred the following day to the rehabilitation unit. Then suddenly it was happening that day instead. I was petrified but also excited, though I had no idea what it was like.

When I arrived, the first thing I noticed was that all the patients were wearing ordinary clothes and not nightwear. The following day was an eye opener for me. While in the infirmary, I had been used to having everything done for me and now it was do-it-yourself time! I was suddenly thrust into a world of therapy—physio and occupational. Every morning we were woken at 8 am and then the day began. I was released on the 15 March 2002 and took home a pair of walking sticks, a wheelchair, and various other pieces of equipment. Gradually I returned to normal life (well almost). My blood pressure was still high and it took a few months to get it under control.

Before my stroke I was very overweight, and since my stroke I have embarked on a healthy eating plan and so far have lost nearly 5 stones. I still have right hand side problems. That side feels very heavy and I have pins and needles throughout my right side, all of the time, but I am much, much better than I was—and I am alive, which is the greatest feeling of all.

Well, that's about it really. Having a stroke has changed my life completely, and although I know this is a really funny thing to say, I am a happier person since. I think it makes you appreciate what you have. Thank you for reading this. It has done me the world of good writing it.

the stroke has occurred. The term “transfer of care” is therefore preferred as a more apt description, emphasising the requirement to organise continuing contact with rehabilitation services.

A Cochrane review shows that for selected, moderately disabled stroke patients, early supported transfer of care using specialist stroke teams can reduce the length of hospital stay (on average by eight days), improve outcomes (reduction in risk of death or dependency by six patients per 100 patients treated), and improve patient satisfaction.¹⁷ A further Cochrane review has shown that stroke patients newly transferred home benefit from continuing contact with specialist therapy services, mainly in terms of less deterioration (seven patients do not deteriorate per 100 patients treated).¹⁸

A review of studies of community occupational therapy as a single discipline showed small additional benefits in functional independence and leisure activities.¹⁹ Single centre trials have reported a sustained improvement in outdoor mobility associated with community occupational therapy^{w20} but not with community physiotherapy.^{w21 w22} The timely provision of aids, equipment, and environmental adaptations is regarded as an essential part of routine care but has not been well researched.

Rehabilitation when the patient gets home

Systematic reviews of qualitative^{20 w23} and quantitative^{21 w24} studies of the experience of stroke recovery have described the diversity, complexity, and frequency of problems faced by patients and carers in the long term. Common problems include social isolation; restricted participation in leisure activities; delayed return to work; anxiety; depression; and distress.

Many studies have highlighted the importance of providing information during stroke recovery, but research suggests that the understanding of stroke and its consequences and the support available remain poor (see box 3). A Cochrane review concluded that passive provision of information (for example, in the form of leaflets) is not associated with improved outcomes, whereas an educational approach (for example, some form of tutoring) might be effective.²² One of the difficulties is the complexity of the information needs (see box 3) and the paucity of effective management for some of the common conditions affecting stroke patients in the long term

Box 3 | Common information needs of stroke patients and their families

- Risk factors and causes of stroke
- Availability of local services and support groups
- Financial advice
- Guidance on driving and transport
- Medication and secondary prevention
- Understanding of an agreed care plan
- Advice on returning to work and participation in leisure activities
- Discussion of sexual issues

ADDITIONAL EDUCATIONAL RESOURCES

Resources for healthcare professionals

- Intercollegiate Stroke Working Party. *National clinical guidelines for stroke*. 2nd ed. London: Royal College of Physicians, 2004. www.rcplondon.ac.uk/pubs/books/stroke/index.htm
- Summaries of current best evidence in stroke care (www.effectivestrokecare.org/)
- Rodin M, Saliba D, Brummel-Smith K on behalf of the American Geriatrics Society Clinical Practice Committee. *Guidelines abstracted from the Department of Veterans Affairs/Department of Defense Clinical Practice Guideline for the Management of Stroke Rehabilitation*. JAGS 2006;54:158-62.
- www.jr2.ox.ac.uk/bandolier/booth/booths/stroke.html

Information resources for patients

- Patient and carer summary of UK National clinical guidelines for stroke (www.rcplondon.ac.uk/pubs/books/stroke/stroke_patientcarer_2ed.pdf).
- Range of information materials is available from the Stroke Association, 240 City Road, London EC1V 2PR (www.stroke.org.uk/).
- National Institute of Neurological Disorders and Stroke (<http://nihseniorhealth.gov/stroke/toc.html>)
- National Stroke Association (US) (www.stroke.org)
- BBC website information (www.bbc.co.uk/health/conditions/stroke/)

(see table C on bmj.com).

Despite the high prevalence of mood disorders, including depression, concern exists that recognition, assessment, and diagnosis of these conditions are poor.²³ However, what should comprise routine care in this area is unclear. Psychotherapy has only a small treatment effect, and the effects of pharmacotherapy are uncertain^{w25 w26} except in the case of emotionalism, for which evidence exists that antidepressants can help^{w27} (see table D on bmj.com).

Several service strategies to improve the long term outcomes have been investigated, including follow-up by specialist nurses, counsellors, and family support workers.^{w28-w32} Provisional results from a systematic review of these studies indicate no associated improvement in health status or independence.²⁴ In England, government policy is to introduce a new community post, the stroke care coordinator, to provide long term follow-up of patients,²⁵ but the duties of this post are unclear.

Conclusion

The strongest evidence for effective stroke rehabilitation relates to better outcomes associated with specialist, coordinated, multidisciplinary teams, both during early inpatient recovery and for resettlement at home. Good evidence exists that most of the key elements of the rehabilitation process are effective, but the detail of which therapies work best for which patients is unclear. Where evidence does exist for specific therapies, it is largely from small, single centre, experimental studies involving selected patients and expert therapists, such that pooled results from meta-analyses are likely to

represent inflated estimates of effectiveness. Large, well designed intervention studies of stroke rehabilitation treatments are needed. The more widespread adoption of stroke rehabilitation units should provide an improved opportunity to mount such studies, and in England and Scotland stroke research networks have recently been established.

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If at first you don't succeed

"If at first you don't succeed, try, try again." The origins of this phrase are not entirely clear, having been quoted as far back as 1840 but popularised in Edward Hicks's *Moral Song* (1857). Whoever originally coined it, most people would agree with its sentiment. Which is why I was surprised that, at a recent meeting on current changes in postgraduate surgical training, a tutor encouraged trainees not successful at surgical selection stages to "go off and do something else."

This made me wonder what the world would be like if everyone who failed to achieve one of their goals did just "go off and do something else."

Beethoven's early tutor once remarked of him that, "as a composer he is hopeless." Beethoven ploughed on regardless, and most would agree that this worked out pretty well for lovers of classical music.

Michael Jordan, perhaps one of the greatest sportsmen of all time, was cut from his high school basketball team. He also decided to stick to what he wanted to do, and I doubt he regrets not doing something else.

Elvis Presley was fired after just one show at "The Grand Ol Opry" and told, "You ain't going nowhere, son." He decided a career in music really was for him, stuck at it, and lovers of sequin jumpsuits and quiffed hair rejoiced.

John F. Kennedy lost a close run election for class president in his freshman year at Harvard but stayed

with it and made do with president of the United States. In fact, if people did give up after one attempt at a career, Americans would have fewer former presidents to remember, as Franklin Delano Roosevelt, Theodore Roosevelt, and Abraham Lincoln all ran for public office early in their careers without success.

But that would be the least of Americans' worries, as the same defeatist attitude would have left them without the famous Dr Seuss books, which were originally rejected by 27 publishing houses.

So worried trainees who find themselves potentially unable to follow their chosen career should take heed. Sometimes a change is a good move, as it was for Sir John Major, former British prime minister, when his application to be a bus conductor was rejected. Or, indeed, Sir Arthur Conan Doyle, who failed to achieve much success in the field of medicine but whose eccentric sleuth Sherlock Holmes assured him a certain immortality.

However, if you have really got your heart set on a particular specialty and things don't quite work out at the first attempt, it is worth persevering. Thomas Edison patented more than 1000 inventions, not all of which were good, before he thought of the light bulb.

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